

## Article for *Chemistry in Action*: **Culturally responsive Science Outreach**

The Scottish team of the Erasmus Plus project 'Diversity in Science towards Social Inclusion' (DiSSI) was tasked with investigating how culturally diverse groups could be attracted to science outreach activities. In this article we describe the principles behind the work we undertook, the activities that we ran and how they were received by people who took part in them.

### **Tools**

We started by considering the features of inclusive teaching which will transcend cultural boundaries, irrespective of the target group.

1. Teach science in the context of pupils' lives and show its relevance
2. Show the pursuit of science as being embedded within diverse cultural contexts
3. Present cultural diversity as a resource to be valued, rather than a problem to be corrected
4. Teach for diverse learners, by deploying a range of teaching and learning strategies; this includes the use of pupil diversity as an aid to learning by facilitating group work. This must be facilitated by the setting of open-ended questions or tasks.
5. Promote understanding by using multiple modalities e.g. sensory experience, pictures, speech, especially speech in various languages, reading, writing and drawing.
6. Focus on process, rather than the outcome, of knowledge creation, both historical and current
7. Present science as a way of constructing meaning rather than uncovering an absolute truth
8. Actively refer to people whose contributions to science are under-recognised.
9. Help pupils to negotiate the discrepancy between scientific language and everyday language, especially for those students who use English as an Additional Language or have poor standard literacy skills.

(Based on Pomeroy, 1994)

The two groups who were considered in the activities were:

1. GlasWeeAsians The activities were directed at those who had an interest in south Asia, whether because of their heritage, personal connections or out of general interest.
2. Pupils educated in the island communities on the west coast of Scotland, where tourism and traditional industries plays an important role in the local economy.

## GlasWeeAsians

The GlasWeeAsian set of activities illustrated the deep, rich, historical connections between the peoples of Scotland and South Asia. Our audiences were introduced to the practicalities of plant transport, the application of plant materials, the documentation of new plants, and the people responsible and recognised during the creation of new knowledge. The activities were designed to be accessible via drop-in sessions at science festivals and in school environments, with a focus on free/cheap materials that could be recycled once the project was complete. No assumptions were made about the audience and their motivation for taking part; they were simply invited to pursue their own interest in the topic and to play (adults and children alike).

Activities included:

- Cyanotype printing plant materials, as well as images of the first acknowledged plant explorers, from Scotland and South Asia
- Designing Wardian cases using junk materials, adapting their builds according to the plant materials (seeds, bulbs, roots)
- “Scratch and sniff” sensory activity matching raw, unprocessed plant materials to their commercially available products using smell and sight

The activities were primarily offered in non-formal learning spaces (such as Glasgow and St Andrews Botanic Gardens) as well as in informal learning spaces (such as Glasgow Science Centre) during British Science Week and Glasgow Science Festival. Our audiences opted in to attending the events in question but not specifically for our activities. Once in the physical space, participation was completely voluntary, save for some gentle persuasion for more reluctant, but still interested, visitors.

The GlasWeeAsian activities were well received as they enabled our audiences to apply their own knowledge and understanding to activities that they hadn't encountered before. As a result of our first event at Glasgow Science Festival, our STEM Ambassador's parent sent us dried and pressed materials from India, illuminated with the scientific plant names as well as their common English and Urdu names. This intrigued our audience and led to increased enthusiasm. These materials have been scanned and high-resolution copies are available here: [FIGSHARE LINK](https://doi.org/10.6084/m9.figshare.22561465.v1) for download and printing onto acetate.

We also collaborated with Dr Saeeda Bhatti (founder and leader of STEM in the Gorbals) to create multi-language evaluation postcards for our audience to complete before and after participating in our activities; this methodology also received ethical approval from the University of Strathclyde

<https://doi.org/10.6084/m9.figshare.22561465.v1> . Upon post-delivery reflection, we realised that these cards are more suited to a workshop style delivery. Science festival environments, with limited staffing capacity, are more suited to tallying visitors or graffiti walls for evaluation purposes. All evaluation should be appropriate, pragmatic, and proportionate to the context.

## “CSI: The Poorly Puffin” – Forensic science meets place-based community learning

The “CSI: The Poorly Puffin” series of short science activities is based around a crime-scene investigation linked to ecological concerns where learners are invited to explore, through a problem-solving approach, who left the (plastic) litter on the beach that was eaten by the puffins. The activities were selected to be accessible to all ages and stages, with an increasing level of complexity which allowed for differentiation by outcome and level of science knowledge and background. Each of the separate activities allowed the learner to get closer to the suspect whilst also exploring their own understanding of science and how this relates to their own place and experiences.

Activities included:

- Footprint matching
- Fingerprint analysis
- Blood typing (using commercially made artificial blood)
- DNA typing.

The activities were offered in the various island communities on the west coast of Scotland, through a range of outreach workshops to teachers and community youth workers, but also to children, young people, and members of the community, both in classrooms as well as informal learning settings. The activities were offered in communities are heavily reliant on tourism, as well as the traditional industries of fishing and small-scale farming, which are particularly affected by the challenges of global climate change and changes to ecosystems.

The “CSI: The Poorly Puffin” activities were well-received as they allowed learners to link their own individual context and sense to place to the wider, global challenges facing societies today in terms of the environment, global climate change, the role of people and science - with clear links to the UN Global Development Goals (especially 14 – in the sea and 15 – on the land). The context of “CSI: The Poorly Puffin” allowed for clear links to be made between the activities and the lived experiences of the participants and eliciting wider discussions – for example in terms of beach debris or awareness of the importance of the protection of wildlife species for future sustainability and employment.

- The activities can be easily adapted to different scenarios and contexts to make them relevant to the learners. All materials are released under Creative Commons licensing and can be downloaded here <https://doi.org/10.6084/m9.figshare.c.6564973>

] for adaptation and reuse.

### Conclusion

All members of the team enjoyed trialling activities that were targeted at groups who are under-represented in science outreach and were pleased that the activities were so well received. We found the framework set out at the start of the article a useful guide to how to approach planning inclusive activities and felt that the range of

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engaged participants, who ranged from toddlers through to under-graduates, indicated their wide applicability. One feature that stood out was that the activities facilitated full involvement by both target groups and others without any distinction being made between them. In that sense, we felt we achieved cultural responsiveness without any sense of ghettoization.

### **References**

Pomeroy, Deborah (1994). Science Education and Cultural Diversity: Mapping the Field, *Studies in Science Education* 24, 49-73